Semiconductor process and device characterization for MEMS (應用於微機電系統之半導體製程與元件量測實作)

Course level: Graduate students

Course goals: This course is intended to introduce typical semiconductor process and the device fabrication and characterization for MEMS, CMOS, and typical semiconductor devices. It focuses on training students the semiconductor process unit and the equipment operation, as well as introducing the clean room facility and rules. Lab practicing is designed to allow students have hands-on experiences to enhance students' understanding of the semiconductor device physics.

Keywords: Semiconductors process, photolithography, Dry/wet etching, thin films, MEMS, CMOS, device characterization

Maximum number of registered students: 24

Pre-requisite: Non

Text books: handouts

Course Outline

1. Introduction Prof. Yu-Lin Wang/Prof. Sheng-Shian Li (9/12)
2. Lab safety rules/ clean room facility: 劉良憶經理 (1week, quiz) (9/19)
3. Photolithography (1): Principe and methods: What is lithography, Light Source and Wavelength, Minimum Line Width and Resolution, Contact and Proximity Printing, Aligner, Prof. Chien-Chung Fu (1 week, quiz) (9/26)
4. Photolithography (2): CMOS/MEMS xx layer, Experiment: spin-coater, Contact Aligner, Prof. Wei-Leun Fang/Prof. Yu-Lin Wang (1 week) (10/3)
5. Thin film (furnace oxides)：Prof. Guo-Hua Feng (1 week, report) (10/17)
6. Thin film (metal deposition: evaporator/ four point probe)：Prof. Da-Jeng Yao/Prof. Yu-Lin Wang (1week, quiz) (10/24)
7. Dry etching (RIE, XeF2): Prof. Sheng-Shian Li (1 week, quiz) (10/31)
8. Wet etching (BOE, TMAH): Prof. Sheng-Shian Li (1 week, quiz) (11/7)
9. Device measurement 1: MOSFET (semiconductor parameter analyzer)：Prof. Yu-Lin Wang (1week, report) (11/14)
10. Device measurement 2: HBT/BJT (semiconductor parameter analyzer)：Prof. Yu-Lin Wang (1week, report) (11/21)

11. CMOS/MEMS dry and wet release: Prof. Wei-Leun Fang (1week, report) (11/28)
12. CMOS/MEMS structure static characterization (Keyence, Zygo): Young's modulus, residual stress, Radius of Curvature, etc., Prof. Wei-Leun Fang (1week, report) (12/5)
13. CMOS/MEMS structure dynamic characterization (LDV, DHM): Resonance, Mode Shape, Quality Factor (MEMS Scanning Mirror) Prof. Wei-Leun Fang (1week, report) (12/12)
14. CMOS/MEMS device electrical characterization (NA, SA, Lock-in): Resonator + CKT measured by network analyzer, spectrum analyzer, Lock-in, Prof. Sheng-Shian Li (1 week, report) (12/19)
15. Semiconductor company tour/Company lecture Prof. Yu-Lin Wang (12/26)

Grading: Quiz and reports: 100%